

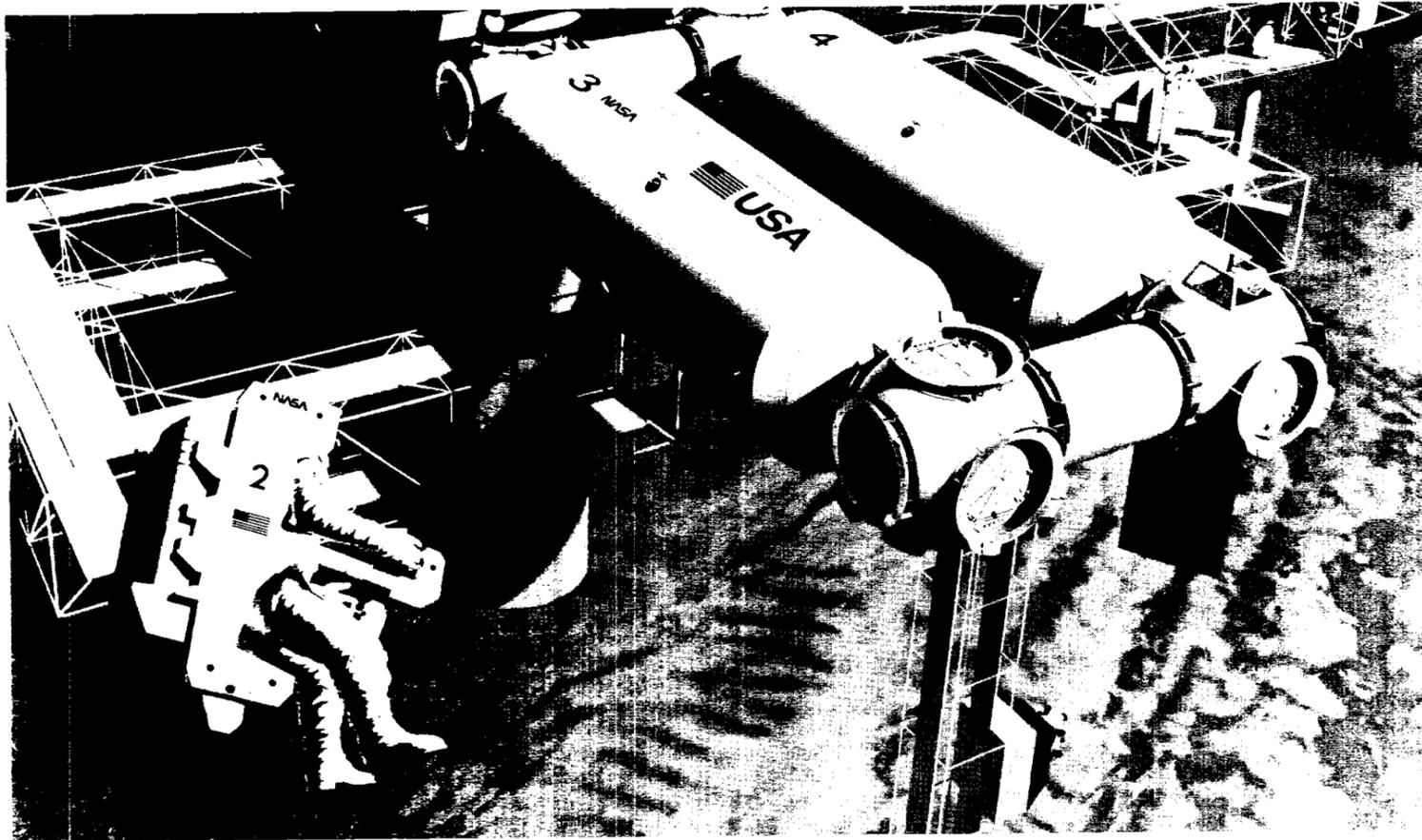
Space News Roundup

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National Aeronautics and Space Administration

Final Station design announced



Plan calls for first hardware launches in 1993

NASA last week announced the selection of a baseline configuration for the Space Station which will be used as a guide during the remaining nine months of Phase B.

The configuration, announced May 14 by NASA Administrator James Fletcher, comes after more than a year of study by NASA centers and contractor teams.

"The Space Station is a challenge of enormous magnitude," Fletcher said, "a challenge worthy of this country. I believe we will accept that challenge, for it will open the door to even greater opportunities for all mankind to expand human knowledge, commerce and enterprise."

Major features of the Station include the adoption of a dual keel configuration, consisting of two vertical keels measuring 361 feet long, connected by upper and lower horizontal booms measur-

ing 146 feet wide. From tip to tip along the transverse boom which carries the power modules, the Station will measure 503 feet long.

The trusswork will be a standard 16.4-foot square and can be erected by astronauts during EVAs. The individual struts will be made of 2.12-inch-diameter, .060-thick tubes of graphite/epoxy.

The U.S. will supply two 44.5-foot-long modules for the initial station. This is a change from the reference configuration, which had four 35-foot-long modules. One U.S. module will provide laboratory functions, the other will be used for crew quarters. The design also includes one smaller logistics module, measuring 24.1 feet in length. The habitation module will be able to house up to eight crewmembers.

The internal module pressure

will be 14.7 psia, and an 80/20 nitrogen/oxygen mixture will approximate Earth sea level conditions.

The environmental control and life support will be a closed system. Oxygen and water will be recycled. Potable water will be distilled and nitrogen and food will be resupplied.

The power system will be of a hybrid design, a change over the reference configuration, which featured an all photovoltaic system. Under the hybrid design, 25 kilowatts will be derived from photovoltaics and 50 kilowatts will be derived from a solar dynamics system. Nickel-hydrogen batteries will provide storage for photovoltaic power during Earth eclipse periods. The primary power distribution in the Station will be AC, probably at 208 volts, although that number is still under study.

The structure of the Station will provide five locations for the placing of attached payloads. It will also have a hangar facility for servicing free-flying spacecraft and platforms. Two coarse pointing systems will be provided, with a pointing accuracy of one arc minute.

Another Station feature will be a telerobotic servicer, designed to be compatible with EVA astronauts and the mobile Remote Manipulator System. Planners believe the telerobotic servicer could ultimately become the "smart" front end for the Orbital Maneuvering Vehicle.

The baseline also includes plans for a polar orbit, unmanned platform, as well as an unmanned platform which will orbit close to the Station. The platforms will be designed to have maximum com-

(Continued on page 4)

Fletcher sworn in May 12 as Administrator

Dr. James C. Fletcher on May 12 became Administrator of NASA for the second time. He promised a review of NASA's current problems, and he said, Space Shuttle flights will resume as soon as safety and prudence allow.

Fletcher was sworn in by Vice President George Bush in a ceremony attended by President Reagan.

During his first full day on the job May 13, he testified before the House Subcommittee on Appropriations and announced that plans are in work to form a group under General Sam Phillips to study NASA's overall program management structure. Phillips was Director of the Apollo Program from 1964 to 1969.

The President welcomed Fletcher back to the job, saying, "This ceremony marks the dawn of a new beginning for NASA, the United States and the Free World. For over 25 years, the men and women, secretaries and scientists, technicians and astronauts of NASA have paved the way to the stars. They have charted new courses for us in a strange and forbidding and yes, sometimes even an unforgiving environment. Some of them have even given the supreme sacrifice.

"Jim, you're coming on board at a time when NASA and the country need you," Reagan said. "We need a steady hand on the tiller. These past few months have been a stormy period for NASA and the space program of the United States. Dr. Bill Graham, who has been serving as the Acting Administrator, has seen us through some high seas and gale force winds, and he's done a fine job. The Space Shuttle and our missile launch programs are the foundations of our nation's journey to the stars and beyond. It's time to rededicate ourselves to this destiny. And in our view, you Jim, are the one to make that happen. So congratulate him." (Continued on page 4)

Ocean search yields Delta first stage engine

The recovery of the first stage engine of the Delta 178 launch vehicle which failed May 3 has been completed. The engine was returned to Port Canaveral May 13 and will be stored in Hangar M.

The engine section was located by the *Scorpi*, a submersible containing television cameras operated by the crew from the U.S. Navy's *Opportune*, approximately 25 miles east of Cape Canaveral.

Lawrence J. Ross, chairman of the Delta Investigation Board for NASA, said, "I am very pleased with the speedy recovery. The team made up of NASA, Air Force, Navy and private contractors have provided the investigation with valuable evidence.

"Although we have not examined the material yet, it has the potential to accelerate the investigation. At the very least it may allow us to rule out some failure scenarios."

The search for the main engine section began a week ago, according to Col. Edward A. O'Connor,

who has been heading the Search and Reconstruction Team.

"The initial radar and visual tracking information allowed us to quickly pinpoint areas of interest," said O'Connor. "The *Freedom Star*, a booster recovery ship, began side scan sonar charting of the area on Monday, May 5. Three targets were quickly identified. The *Edwin Link*, owned and operated by the Harbor Branch Foundation, was brought in Thursday and raised the second stage avionics and guidance packages."

Refinement of the tracking data showed the main engine section probably splashed down about three miles from that site and side scan sonar showed targets at the new site. The *Sea Link I* was deployed on Sunday but was unable to work because of the sea surge and zero visibility. It had to return to Fort Pierce to go on another assignment late Sunday.

The *Opportune* and *Scorpi* began

looking at the area Monday morning and located main engine debris. Further efforts led to the recovery of the main engine.

Rear Admiral Richard H. Truly, NASA Associate Administrator for Space Flight, last week announced the composition of the team to investigate the May 3 loss of the Delta 178 mission. The board will investigate and recommend corrective action for the Delta 178 failure and will report its findings and recommendations not later than July 2, 1986, to Admiral Truly, who will forward these to the NASA Administrator.

Ross, chairman of the investigation board, is Director of Space Flight Systems at the Lewis Research Center.

Other members of the board are: William C. Bradford, Director, Information and Electronic Systems Laboratory, NASA Marshall Space Flight Center, Huntsville, Ala.; Jerry Thomson, Flight Engineering,

Science and Engineering Office, Marshall Space Flight Center; Jon J. Busse, Deputy Director, Engineering Directorate, NASA Goddard Space Flight Center, Greenbelt, Md.; Chester A. Vaughan, Deputy Chief, Propulsion and Power Division, Engineering Directorate, NASA Johnson Space Center, Houston; Creighton A. Terhune, Integration Office, Payload Management and Operations Directorate, Kennedy Space Center; John H. Johnson, Assistant Chief, Tracking and Communications Division, Engineering Directorate, Johnson Space Center; and Don Hart, Director, Rocket Propulsion Laboratory, Edwards Air Force Base, Calif.

Admiral Truly stressed that, although all members of the investigation board have extensive experience in the area of expendable launch vehicles, none was involved in the preparation or launch of this particular mission. Truly also promised the assistance of the organiza-

tion already in place at NASA Headquarters supporting the investigation into the Space Shuttle *Challenger* accident to serve as the Headquarters coordination point for the Delta investigation.

The flight of the Delta 178, carrying the Geostationary Operational Environmental Satellite (GOES-G), ended approximately 90 seconds after a nominal liftoff from Complex 17A, Cape Canaveral Air Force Station, at 6:18 p.m. EDT May 3, 1986. According to program officials, countdown and liftoff proceeded without difficulty. At about 71 seconds into the flight, the mission was proceeding normally when, as program officials said in a post-launch news conference, the first stage engine shut down abruptly. With loss of thrust and attitude control, the vehicle entered a tumble and approximately 20 seconds later the Range Safety Officer sent a destruct signal to destroy the system.

Employee fitness program showing results

By Janet Ross

Since 1983, the number of people using the Gilruth Recreation Center has almost doubled, and Larry Wier believes the Center's employees fitness program may have something to do with it.

Wier, JSC's Physical Fitness Director, has been conducting a series of 12-week fitness courses for employees since September 1983. In that time, about 600 employees have completed the program, and many have been able to use the educational and motivational aspects of the course to substantially improve their fitness habits.

Ted Paulos, Head of the Telecommunications Services Office, is an example. He lost 25 pounds, two inches around the waist and ran in the Houston Marathon in January. "I was aware that I needed some physical exercise," he said, "and at the beginning of the course, I ran 100 yards and quit. But I've got to give Larry the credit for this thing, because he set the goals and the pattern. I got most of my motivation from him." Paulos now runs an average of 21 miles a week and does not experience headaches that were common before. "I get a headache so rarely now that it's just a surprise," he said.

Many others have shared the same type of experience. Wier believes the success rate of the course may be due to the emphasis on education and motivation. "Our program is different than others," he said, "in that we require a thorough education phase before you can even be in the program. I know of no other place that has that requirement."

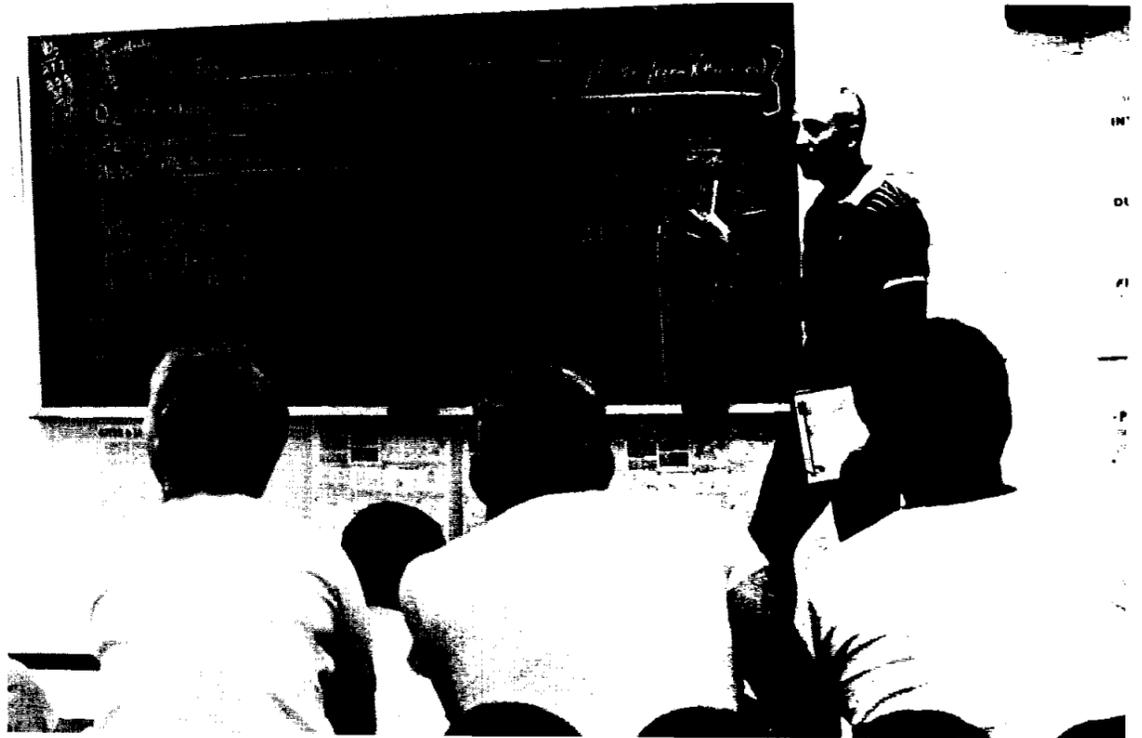
This classroom part of the program covers such topics as strength

training, musculoskeletal function, exercising in the Houston environment, basic nutrition, weight management, cardiovascular disease, hypertension and blood pressure. Other topics include obesity, psychological stress and depression, and how age and gender influence exercise. Applicants are given a written exam and undergo fitness appraisals during the last quarter. Exercise sessions are held throughout the 12 weeks.

Before being accepted into the program, applicants must take a general physical, and this is where Wier and his assistant, Mary Pinkerton, are able to work individually with each person. Wier consults with each applicant, explaining in detail their level of physical fitness. The fitness staff then designs a tailor-made fitness program for each person.

For motivational reasons, graduates of the program are asked to return every three months for a retest. The basic components of fitness are measured through tests of flexibility, muscular strength, relative body fat and cardiorespiratory endurance. The retests reflect Wier's philosophy that a three-month exercise program is meaningless without a commitment to continue. "The goal is to change people's habits. Success is a matter of staying fit as a way of life."

The number of people using the Rec Center has more than doubled since the fitness classes began. Wier has found the peak times for people to work out in the weight room, exercise or jog are weekdays from 11:30 a.m. to 12:30 p.m. and from 4:30 to 6 p.m. In the fall of 1983, the average attendance in the weight room was 67 people a



Larry Wier explains the body's expenditure of energy to employees in his fitness class.

day. In April 1986, the average crowd was around 161 people. The highest average, of 169 people, was recorded in February.

Wier said he finds it gratifying to see changes in people as a result of the fitness program. Moreover, he said he likes to see them take the initiative. "I think it's my duty to educate people, but not to whip them into shape. I've seen a lot of changes made. Some people have quit smoking cigarettes and are eating better diets, and even run marathons. We explain how to do things. After awhile, it's up to them to stick with it."

The program, according to

Beverly Anderson, Secretary to the Artificial Intelligence Office, is "definitely worth it." She is currently enrolled in the course and said it has "been a terrific psychological benefit." Like other participants, she has developed an exercise routine, set goals for herself and made new friends. "The staff members over there are really interested in changing people's lives."

Another graduate of the class is Sandy Richardson of the Mission Planning and Analysis Division. "I'm a firm believer that fitness helps attendance here at work," she said, "and I like seeing all of these people working to improve their health."

One of Richardson's goals was to learn all she could during the classroom part of the course. "There were a lot of things I didn't know about physical fitness. The things Larry taught us were very interesting. I set out to learn some of those things, and I did."

All JSC employees, contractors, retirees and their dependents are eligible to apply for the classes. Two sessions will be offered during the remainder of 1986: from July 7 to Sept. 26 and from Sept. 29 to Dec. 19.

For more information on the program, call the physical fitness staff office at x3531.



Bulletin Board

Bicycle Club meets June 3

The JSC Bicycle Club will hold its next meeting at 7 p.m. June 3 at the Freeman Memorial Library. The meeting will feature a showing of the film "American Flyers." The group is open to all persons with an interest in bicycling. For more information, call Kitty Barnes at 480-9100.

ContraBand concert is May 30

The 20-piece ContraBand Swing Band, staffed mostly by JSC employees and contractors, will sponsor a dance from 8 p.m. to midnight May 30 at the Hobby Airport Holiday Inn Atrium Hotel & Convention Center, located at 9100 Gulf Freeway. All ticket proceeds will be donated to the Challenger Benefit Fund. This tribute to the Challenger crew is special to the band, since 51-L Mission Specialist Ron McNair played lead tenor saxophone in the band for three years (see related story, this issue). Advance sale of tickets is underway. The \$10 tickets

are available in Bldgs. 4, 17, 29, 37 and T-585. Flyers posted in the buildings will direct you to a band member. Beginning May 21, tickets will be on sale from 11:30 a.m. to noon in the Bldg. 11 Cafeteria. Offsite members of the band may be found in the Rockwell, IBM and McDonnell Douglas facilities. For more information, call Milt Heflin at 488-5903 after 6 p.m.

Ada conference to be in June

The first international conference on Ada programming language applications will be held June 2-5 at the Nassau Bay Hilton Hotel. Sponsored by JSC and the University of Houston-Clear Lake, the symposium will focus on NASA's space station data management system, a large and complex global network of computer resources. The conference will feature discussions on software development, operating systems, hardware, fault tolerance, software reusability, software applications, communications, distributed data

bases, real time control and interfaces to other languages.

EAA offers Astros tickets

The JSC Employees Activities Association has purchased tickets for two Astros games this summer at the Dome. Tickets for the June 27 Dodger game will be \$5 and will go on sale June 9. Tickets for the July 18 game with the Mets will be \$7.50, including refreshments, and will go on sale June 30. The seats are on the field level, adjacent to first base for one game and third base for another. The tickets will be on sale at Bldg. 11 Exchange Store.

EAA plans rafting trip

The Employee Activities Association will sponsor a rafting trip down the Guadalupe River on Saturday, June 28. Tickets go on sale May 19 and will include the bus transportation, the raft trip itself, BBQ beef dinner, and a country and western dance. Rafterers may also choose all of the

above but skip the dance. Tickets are \$31 per person, or \$26 without the dancing. About 45 tickets are available in either category. For more information, call x4814.

Radio Club to hold meeting

The JSC Amateur Radio Club will hold its next meeting at noon May 29 in Room 151, Bldg. 16. The meeting is open to all persons interested in amateur radio. For more information, call Byron Boeckel, x4631.

Pressure Systems Week set

The theme for this year's Pressure Systems Week is "Pressure Systems Safety and You." The purpose of the week-long observance is to highlight safety aspects of pressure vessels and pressure systems. Hot water heaters, compressed gas cylinders, compressors and aerosol cans are a few of the potential hazards which will be discussed. Presentations will be made at the Learning Center, Bldg. 226N, from 2 to 3 p.m. June 3 and from 1 to 2 p.m. on June 4 and 5.

CADS catches on

The use of computer aided design now seen in many areas

In this two-part series, we examine the many uses now being made of computer aided design systems at JSC. From streamlining once time consuming tasks to making new things possible and exciting employees in the process, CADS systems are catching on here, and showing up in more and more places.

By Barbara Schwartz

With little fanfare, JSC has emerged recently as a leading center for productive and innovative use of computer-aided design (CAD) systems.

"We have come a long way in the last three years from isolated pockets of CAD capability to the present environment of state-of-the-art CAD systems linked by redundant, high-speed, site-wide, computer-to-computer networks," said Robert D. Schwartz, Manager of the Engineering Computer Systems Office.

In 1983, Dr. Aaron Cohen established a goal for the Research and Engineering Directorate to develop proficiency in utilizing computer-aided design systems. Thomas Moser, then the Director of Engineering, directed the Structures and Thermal Division to serve as focal point for integrating CAD capability within the Directorate. By the spring of 1984, a CAD Working Group had been formed and included representatives from engineering and science disciplines to develop and implement the capability. At about the same time, the Chief Engineer at NASA Headquarters established an Agency-wide CAD Steering Committee, further emphasizing the need to develop an integrated capability.

"Since its establishment, the CAD Working Group has been expanded to include interested representatives of other organizations such as Technical Services, Facilities, and Reliability and Quality Assurance. Currently, there are at least six major CAD systems hosted by super mini-computers plus a number of personal computer-based systems, with about 200 CAD users Center-wide," Schwartz said.

CAD systems at JSC are more than an electronic graphics replacement for the designer's drawing board. They are used to support a multitude of computer-aided engineering (CAE) activities as well. For example, a structural engineer can begin with a conceptual design, transform it into a detailed drawing from which hardware can be manufactured and tested, or from which an analytical model may be developed for structural analysis.

"One of the great productivity advantages of the CAD system is that concepts, designs, and models can be easily and quickly changed," Schwartz noted. Users of the CAD

system agree that increased productivity is a major benefit of the system. "Productivity," Schwartz said, "can also be measured by the ability to do things that could not even be accomplished without the CAD system." Examples of this new capability can be seen in all the areas using CAD systems.

A recent demonstration of benefits derived from use of CAD systems was the work done on the STS 51-L accident investigation. Engineers in the Advanced Programs Office and the Structures and Mechanics Division used a combination of telemetry data, photography, camera angles, and the CAD system to pinpoint where the black puff of smoke came from as the right hand solid rocket booster (SRB) ignited on liftoff, to locate where the flame originated, and to determine what happened during SRB rotation.

Tim Pelischek, a structural design and analysis engineer in the Structures and Mechanics Division, described how he and his co-workers used the McAuto CAD system to aid the accident investigation. "We used actual trajectory information that was sent down from the Shuttle on roll, pitch and yaw to get the exact orientation of the Shuttle."

Using large CAD system drawings of the assembled Orbiter, external tank, and SRBs taped to a conference room wall, the Structures group overlaid 70mm slides of Challenger's flight trajectory. Obvious reference points that were easily discernable in the photographs, such as SRB joints and attach struts, were used to precisely align the two pictures. By adjusting the CAD drawings to match the photographs, measurements of the actual SRB rotation could be determined.

The same technique was used to determine the area from which the flame originated. For locating the flame, two different camera angles were used — a bottom view as well as a side view of the Shuttle.

In analyzing the puff of black smoke at SRB ignition, photographs from three camera angles were used to determine that the smoke was not coming from the test port, as originally thought, but from the SRB joint area.

Pelischek, emphasizing the usefulness of the CAD system in these investigations, said, "We wouldn't have had the same degree of certainty. We would have had a hundred different people with a hundred different guesses about where the flame was coming from. It would have been a judgment

thing — just looking at photos. This has more information to base your judgment on. You can narrow it down better." Examples of other ways in which Structures engineers have been using their CAD system are for structural analysis of Shuttle brakes and determining aerodynamic characteristics of the aerobraking surface on the proposed Aerobraking Orbit Transfer Vehicle (AOTV). The AOTV is one concept for a Space Station-based ferry vehicle that would have the capability of going to and from Space Station altitude of about 250 miles and a high Earth orbit of about 20,000 miles.

The aerobraking concept would save fuel on return from high altitudes by using the Earth's atmosphere to slow it down and level it off instead of firing rockets. Pelischek described the method to be "like skipping a stone off water." He said plans are to make a 14-foot experimental model of the AOTV for testing on a future Shuttle flight. Recently, a four-inch model and a three-quarter inch model of the aerobraking surface were generated by Technical Services for wind tunnel testing. The CAD design was transferred electronically to Technical Services where a paper tape was produced to drive the CAM (computer-aided manufacturing) equipment on which the models were fabricated. An advantage of the CAD/CAM system is the ability to enlarge or reduce scale having to produce drawings — the definitions are precise in any size.

The GE CALMA CAD system in the Advanced Program Office also was used in the 51-L investigation. S. Michael (Mike) Goza, a technical intern in the Computer Support Office, produced the color computer graphics of the SRB impingement that were presented to the Presidential Commission on the Challenger accident. One of the graphics released by the Commission was printed in the trade weekly, "Aviation Week and Space

Technology." Goza used the GEOMOD solid modeling system to produce the fully colored and shaded life-like pictures.

Wayne Peterson, an aerospace engineer in the Conceptual Design Section of the Advanced Programs Office, also provided support for the 51-L accident investigation. Using the solid modeling system, which has the capability of automatically determining mass properties, Peterson was able to assess what happened when the right hand SRB aft attach strut broke loose and caused the booster to strike the external tank. After the SRB was rotated, an interference check was performed on the computer-generated solid model of the STS vehicle. The check confirmed that there was what engineers call "interference volume" between the external tank and the right SRB just above the forward attach point.

Peterson, who graduated last May from Texas A&M University, began his career at JSC as a cooperative education student just over three years ago. His speciality is conceptual design, and he says computer technology helps. Design is based on what has been successful in the past. Therefore, one of the advantages of the CAD system from the conceptual design perspective, he said, is the ability to create essentially a warehouse of components and have the capability to assemble them; rearrange them; calculate the new design's mass, volume, center of gravity and inertia, and electronically send the design to other areas for analysis or fabrication.

Solid modeling, as opposed to line drawings, will not allow anything to be designed that is physically impossible to build. This feature is especially handy in the conceptual design area when initiating original designs.

Peterson is now working on design concepts for Orbital Maneu-

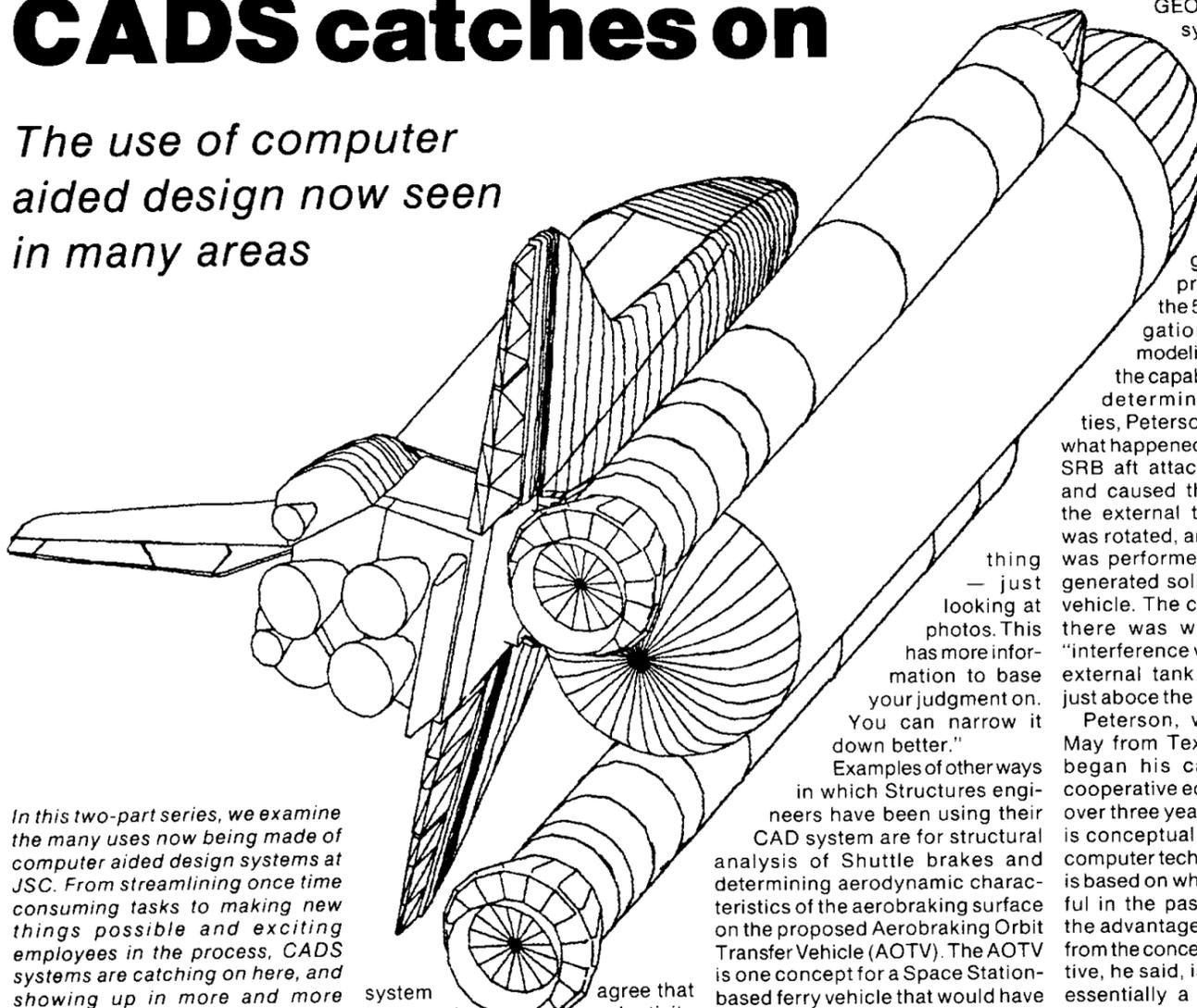
vering and Orbital Transfer Vehicles, the manned and unmanned logistics ships planned for use with the Space Station to ferry satellites back and forth from geosynchronous Earth orbit.

Goza, who designs software for the conceptual design experts, is currently working on using solid models to show fluid slosh in a tank. "There is a program that was written a while ago that does three-dimensional fluid slosh, but there is no way to visualize it. The program also calculates forces and moments due to the fluid slosh. One example is the external tank separating from the Shuttle. Engineers wanted to know what would happen when you separate if there is still fluid in there. It's going to slosh; it's going to create forces inside there. Is that going to be enough to slam it into the bottom of the Shuttle?" The program was developed to provide that information for return to launch site (RTLS) aborts.

As an off-shoot of that program, Goza is adapting the software so it will provide the same type of data for microgravity conditions which will be beneficial for Space Station design concepts. Now the program requires some sort of gravity gradient to keep the fluid against the side of the tank. "I'm going to make it so it can handle fluids separating completely from the tank, flying across it and slamming into the other side. I'm also working on the visual part of that as well," said Goza.

Although the Conceptual Design Office works on Space Station related designs, they do not design the Station itself. Space Station engineers and designers are using a CAD system similar to systems used in the Advanced Programs Office. It has its own library of parts that can be assembled and reassembled according to requirements for Phase B design.

Next issue: How CADS is used in the Electronic Systems Test Laboratory, and how manufacturing jobs in JSC's Technical Services Division are made easier by computers.



Tim Pelischek explains how the McAuto graphics system was used by the Structures and Mechanics Division to aid the 51-L accident investigation. On screen is a typical line drawing generated by the system.



Solid modeling is another CAD feature used at JSC. An example of the shaded, life-like pictures it produces can be seen on the screen between Mike Goza, at left, and Wayne Peterson, standing. Ray Nelson, CAD/CAM Coordinator for the Advanced Programs Office, is seated at right.

Hundreds gather for annual JSC picnic



Hundreds of employees gathered at the Gilruth Recreation Center May 3 for the annual JSC Picnic. As with past gatherings, the picnic included music and dancing, Texas barbecue, the inevitable dunk tank and offerings for the children. (Photos courtesy Dale Martin)



Fletcher appointment announced

(Continued from page 1)

ulations and God bless you." At a press conference May 12, Fletcher said NASA's forecast of resuming Shuttle flights in the summer of 1987 is reasonable, but that, "we aren't going to fly until we are absolutely convinced that it's safe. We do have a pretty extensive test program planned and will review all procedures, decision making and quality control down to

third tier contractors if necessary. That's ambitious, but we think it can be done in 18 months. If we don't finish in 18 months, we just won't fly."

When asked if he thought the Agency was in disarray, Fletcher said he did not think that was the right word to use. "I haven't had a chance to visit the centers and so I get the impression that disarray is not the right word," he said. "They

are waiting to see what the President is going to do, for example, about the supplemental to restore the Orbiter and provide the funds for fixing the problem. I think they are ready to go back to work, and I think they'll be as dedicated and more motivated than they were before the accident."

Upon leaving NASA in 1977 after his first term as Administrator, Fletcher accepted the William K. Whiteford Professorship of Energy Resources and Technology at the University of Pittsburgh, where he remained until May 1986. During this period, he also headed his own consulting firm, James C. Fletcher & Associates, McLean, Va.

Fletcher began his career in 1940 as a research physicist with the U.S. Navy Bureau of Ordnance, Washington, D.C. In 1941, he became a special research associate at Cruft Laboratory, Harvard University and, in 1942, he was an instructor at Princeton University.

In 1948, Fletcher joined Hughes Aircraft Co., El Segundo, Calif., where he served for 6 years. Later he joined Ramo-Wooldridge Corp.'s Guided Missile Research Division in Redondo Beach, Calif., which later became Space Technologies Laboratories. In July 1958, with an associate, Fletcher organized and was first President of Space Electronics Corp., El Monte, Calif., which developed and produced the Able Star stage of the Thor-Able space carrier. After merger with a portion of Aerojet, Fletcher became President and then Chairman of the newly-formed Space General Corp. Later he served as Systems Vice President of Aerojet General Corp.

In 1964, he became the eighth president of the University of Utah, a post he held for 7 years.

As a research scientist, Fletcher has developed patents in sonar devices and missile guidance systems. He has been associated with the President's Science Advisory Committee, 9 years as a member of subcommittees and 4 years as a

member of the committee itself, and has served on several Presidential task forces and many government-industry committees.

He is a Fellow of the Institute of Electrical and Electronics Engineers, American Institute of Aeronautics and Astronautics, the American Academy of Arts and Sciences, the American Astronautical Society and was elected to the National Academy of Engineering. He was a recipient of the first Distinguished Alumni Award of the California Institute of Technology and holds an honorary doctorate from the University of Utah.

Born June 5, 1919, in Millburn, N.J., Fletcher received a B.A. degree in physics from Columbia University in 1940 and a Ph.D. in physics from the California Institute of Technology in 1948.

He is married to the former Fay Lee of Brigham City, Utah. They are the parents of three daughters and one son.

Space Station

(Continued from page 1)

monality with the Station. The Station propulsion system will be gaseous hydrogen and oxygen and will provide altitude boost when needed. Thruster modules will be located on the four quadrants of the Station and each thruster will be in the 10 to 50 pound range.

The Station will be assembled at 220 nautical miles. The operational altitude will be a minimum of 250 nautical miles.

The standard units of measure on the Station will be metric. Deviations will be permitted only where costs of implementing metric are unreasonable.

The Station will include international elements supplied by Canada, Japan and the European Space Agency.

Canada will provide the Mobile Servicing Center, an outgrowth of that country's expertise with the remote manipulator system now used on the Shuttle.

Japan is conducting preliminary design work on a pressurized laboratory module with a manipulator arm, an attached work deck (sometimes known as the "front porch"), and an experiment logistics module.

Discussions with ESA focus on a permanently attached pressurized laboratory for life sciences and materials experiments, a polar platform and a co-orbiting platform.

As directed by Congress, NASA and the contractor teams also studied the feasibility of initially man-tending the Station and phasing in a permanent presence over a three to five year period. In the man-tended mode, the Station would not be operated unless an

Orbiter was docked to it.

The study, presented to Congress May 12, concluded that while the approach is technically feasible and could accommodate certain functions, the phased approach would force postponement of experiments and would increase the total cost of development.

The study estimated that costs deferred between FY 1987 and 1991 by the man-tended approach would be approximately \$284 million in 1984 dollars. But the total cost in going with a man-tended capability, as a 3-year phase before permanently manning the Station, would be approximately \$1 billion. "If operated in a man-tended mode for several years before achieving permanently manned capability, the small near-term savings achieved by these cost deferrals are offset by the costs of both operating the Station in a man-tended mode and maintaining the industrial base during the delay period before resuming assembly of the permanently manned Space Station," the report said.

A total of 25 Shuttle flights will be required for assembly of the baseline Station. That figure includes flights to assemble the Station and the polar and equatorial platforms, as well as supply flights

The current schedule calls for NASA to begin development of the Station elements in the spring of 1987. The first launch of hardware would take place in 1993, and a habitable Station would be in place by late 1994. Remaining flights to complete assembly of the Station would take place over the following two years.

Armitage to leave JSC

JSC has said goodbye to the last of the Canadians.

Peter J. Armitage, Assistant Director of Space and Life Sciences and the last JSC member of the group of Canadian engineers that bolstered the Space Task Group in the early 1960s, retired May 9.

He plans to begin what he called his "fifth career" in Ft. Lauderdale as Executive Vice President of ACR Electronics.

Armitage designed helicopters in Great Britain and flew bombers for the Royal Air Force in World War II. After the war, he went to Canada and worked in flight testing of the Avro Arrow. When the Canadian Government cancelled that program, Armitage and around 30 other engineers joined the Space Task Group at Langley Field, VA at the start of Project Mercury.

Armitage is the last member of that group to work at JSC.

In a Roundup Interview last May, former Shuttle Program Manager Glynn Lunney reflected on the impact the group of experienced Canadians had on the Task Group:

"America lucked out," Lunney said. "The people from Canada came in and contributed a great deal in terms of the seasoning of the group. . . We put all of that to-

gether and it just rolled."

Armitage said he will remain in the Clear Lake area for the next few weeks before moving to Ft. Lauderdale.



Pete Armitage, bound for Ft. Lauderdale, poses with Dr. Joseph Kerwin, Director of Space and Life Sciences, and a pair of shorts intended for the tropical climate.

The rise of a swing band

By Milt Heflin

For seven years now, one of JSC's premier social events has been the annual Mission Operations Directorate Chili Cook Off. With teams issuing sometimes bawdy propaganda about one another, adopting often tasteless team names and going to great lengths to impress the judges, Cookoff Week is generally considered to be a raucous, no holds-barred, morale-building event spread over three days. This year's version, with 26 teams participating, was the biggest yet. The Pre Cookoff Kickoff, held May 7 at the Rec Center, featured the flyby of an aircraft trailing a streamer which warned chili buffs to "Eat Maggot Chili or Die," and even saw the debut of a black market publication suspiciously familiar to this one, called the "Chili News Roundup." But in the larger scheme of things, it was the very first Cookoff, in the spring of 1979, that may have had the biggest impact. One legacy of that event was the formation of a small band which has grown into a near professional organization. From the "Trash Can 5," the combo grew into "ContraBand." The group now numbers 20 musicians and has played the Remington, the Galvez and the Moody Center, among other places. Some of their arrangements are original, and the band stays booked. On May 30, ContraBand will appear in concert to benefit the Challenger Fund, and to honor former band member Ron McNair, whose influence on the course of ContraBand was substantial. The following first person account, written by Flight Director Milt Heflin, one of the original members of the TC5, traces the history of the band and its members.

Who would ever have thought that a bowl of chili would play a role in the formation of a tuxedo-clad group of musicians, playing Big Band music at places like Houston's Remington Hotel and Galveston's Moody Center?

It doesn't seem likely, but that was a special bowl of chili.

It was produced by the Bay Area Refuse Farm (BARF) Chili Team, and it won first place at the First Annual FOD Chili Cookoff in April 1979.

A small band that was part of that effort, as the BARF team's entry in the showmanship category, got caught up in the euphoria of victory and continued to shadow the team at other cookoffs in the Houston area. By the end of 1979, the band had survived 14 appearances, even one involving the Banditos Motorcycle Club.

The history of the band goes back to January 25, 1979. It was less than six weeks before the first Chili Cookoff and the search was on for a showmanship entry. Four employees of a branch in the old Flight Control Division discovered they could muster up some musical experience from their distant pasts.

Together they could boast some capability with drums, trumpet, clarinet and one of them was just learning the guitar. The following week they suckered an ex-trombone player—who had last played 19 years before—into joining the group, and the Trash Can 5 was born.

It was a brassy band, so to speak, which even had the courage to play the closing portion of Tchaikovsky's 1812 Overture, complete with cannon!



In 1980, the band began to change. The band added four more musicians and a real search began to find and establish a musical style. At the same time, the name of the band was changed to ContraBand, since the makeup of the group appeared, and sometimes sounded, to be "contra" to establishing any useful identity.

But about the middle of the year, the band picked up a new tenor saxophone player who would shape the things to come.

Ron McNair arrived one Sunday night and cut loose with a Jazz ad lib in the middle of an otherwise mundane tune. One by one, the other band members quit playing and listened. It was electric. With a great deal of excitement, the group recognized that a new direction for the band had just walked through the door.

It took some work, and in the meantime, the identity crisis wasn't quite over. The band finished the year by playing at a few more chili cookoffs, a flag football game (one band member doubled as tight end), and a parade in LaPorte, playing from a trailer pulled by a jeep.

The band's first paying job was a party to honor the mayor of LaPorte, and people first danced to the music of ContraBand at a wedding reception in May of 1980.

The next two years or so were spent adopting a Big Band style. This labor of love was paying off, as the band grew to full stage band size with 5 saxophones, 4 trumpets, and 4 trombones, plus piano, guitar, bass drums and a vocalist. With these additions, the band's name was modified again to add the words "Swing Band," and we refer to it as CSB.

Since the TC5 years, the band has performed 119 times, and band alumni now number 22. Another trumpet and sax have been added recently, bringing the active membership today to 20. Besides the Remington and Moody Center, CSB has played the Hotel Galvez, the San Luis and the Balinese Room. CSB has appeared at the last two Galveston Mardi Gras celebrations, has performed 10 times at the UP's club in Kemah and has become a regular at the Houston Yacht Club.

Today, ContraBand is under the musical direction of Mike Weston, an engineering manager for IBM. Mike is an accomplished saxophone and clarinet player and fills in as required. His previous band experience was at Auburn.

Karen Johnson, a ground navigation flight controller with Rockwell Shuttle Operations Co., is President of CSB and plays the trumpet and flugelhorn. She also is a board member of and musician with the Pasadena Philharmonic. When she finds the time, she substitutes in the Galveston orchestra, and plays in locally produced musicals.

First tenor saxophone Ben Edwards is a senior research scientist for Technology, Incorporated. He played in the Aggieband Orchestra and the U.S. Air Force Stage and Dance bands. He has also spent some time recently with the College of the Mainland Jazz Ensemble.

Linda Godwin, selected to the Astronaut Corps last year, plays second tenor sax and clarinet. She played clarinet in high school and college. During her CSB experience, she also has become a solid saxophonist.

Lead alto sax is played by Bob Schaf, a lead Flight Activities Officer in the Mission Control Center. As one of CSB's outstanding soloists, he also plays the flute and soprano sax, although his last band experience was during high school.

Another accomplished soloist on alto and tenor sax is Greg Peticolas, an electrician at the Warwick Hotel and a recent addition to the band. He attended San Jacinto College where he majored in music, and plays in three other bands as well.

Grace Tice, a financial analyst for the Shell Oil Company, came to the band out of North Texas State University, where she earned a bachelor of music degree. She plays the alto and baritone saxophones and teaches private oboe lessons in the area. She is married to CSB's lead trumpet player, Paul Tice, who works for RSOC as a Spacelab flight controller. His music background includes marching instructor and lead soprano bugle section leader for the "Troopers Drum and Bugle Corps" of Casper, Wyoming.

Another member of the trumpet section is Steve McCree, who just recently left the space business, where he worked as an engineer in Crew Systems, to start his own marine engineering business in Kemah.

Like McCree, Craig Seanor had not played his trumpet in several years when he joined CSB. Now a staff programmer for IBM, Seanor has been a disc jockey, a music director and the general manager for programming at his college radio station. The disc jockey experience makes him a natural for the job of band announcer.

Terry Dunn, another trumpeter, is the newest member of the band. He is a fire fighter for the City of LaPorte and has musical experience with Memphis State University and the Navy School of Music. He has brought exceptional solo and high note work to the trumpet section, and also plays flugelhorn.

Lead trombone chores are more than covered by Texas A&M graduate Ray Miessler. His experience on trombone spans 18 years, and during his time at A&M he was on every band they had. Miessler, an RSOC engineer, serves as a Shuttle electrical systems flight controller. With his electronics background, he was put in charge of managing all of CSB's sound equipment.

Another College of the Mainland Jazz Ensemble player is George Warren, who plays second trombone for CSB. Warren also handles many of the trombone solos for the band. He played in his high school band in LaMarque and is employed as an electrician in the Texas City area.

Dave Johnson has been with the band since 1980 but just recently brought a new sound to the group with his bass trombone. Like many of the band members, his only previous experience was in high school.

One of the original Trash Can 5 band members is percussionist Al Pennington, a Shuttle Flight Director and former INCO flight controller. Pennington played through a couple of years at the University of Oklahoma and spent some time with a 5-piece group.

Dennis Webb, another TC5 hold-over, started out as a living room folk guitarist in the 1970s. He is the only CSB musician who didn't acquire some type of formal musical education prior to joining the band. He is a show within a show, and in much calmer surroundings is a staff assistant for planning in MOD's Systems Division.

Andrea Martin came to CSB in November 1985 with substantial musical education. She is pianist for the band and has arranged several numbers. She earned a masters of music in composition from Rice University in 1982 and has premiered two of her own compositions with the Shepherd School of Music Symphony.

Holly Barnes, a unit supervisor and flight dynamics specialist for RSOC, came to the band as a saxophone player but had hopes of someday becoming a first rate trumpet player. But she saw the need for a guitar player in the band, decided to give it a try, and has become CSB's lead guitarist.

ContraBand's vocalist is Aleshia Hudson, a technical coordinator for IBM. Her previous experience was with church choirs and weddings, so she took a big step in singing with a Big Band. With her debut in the summer of 1982, she added a new dimension in sound and energy to the band.

The author, who plays trombone for ContraBand, has junior high and high school experience before a 19-year musical hiatus. He has been a NASA employee since the Apollo program and was an EECOM flight controller for the first nine Shuttle flights. He was a flight director on the STS 51-D, 51-G, 51-J and 61-C missions.



Snap shots from the ContraBand family album: At upper left, the original Trash Can 5 featured, left to right, Dennis Webb, Milt Heflin, Al Pennington, Barbara Pearson, and Larry Minter. At lower left, a shot of the band at the Hobby Hilton in December 1985. Below, Ron McNair during his last appearance with the band in September 1984.



Roundup Swap Shop

All Swap Shop ads must be submitted on a JSC Form 1452. The forms may be obtained from the Forms Office. Deadline for submitting ads is 5 p.m. the first Wednesday after the date of publication. Send ads to Roundup, AP3, or deliver them to the Newsroom, Bldg. 2 Annex, Room 147. No phone in ads will be taken.

Property & Rentals

Sale/lease: Friendswood custom 3-2-2, by owner, FPL, fans, miniblinds, large yard, \$89,900, 9.5% FHA, owner finance equity, or \$650/mo. 482-9189.

Lease: University Trace condo, 1-1.5-1, W/D, refrig., FPL, adult pool, security alarm, drapes, covered pking., great location. Tony, x3421 or 554-2079.

Sale: 1 week time share condo in Kissimmee, FL, \$8,000 value for \$6,000, includes paid up membership for 8 yrs. in RCI and 2 weeks space banked. 332-0047.

Sale: Heavily wooded 2 acre lot in Splendora, all util. avail., owner will help w/some financing, \$5,000 down on \$16,000 total. 332-0047.

Lease: Nassau Bay 5-2.5, FPL, large deck, large fenced yard, micro/ovens, fans, new heat pump, hot tub, recent renovation, \$950/mo. David Youngblood, x4111 or 333-4562.

Sale: Scarsdale 3-2-2, Woodmeadow, by owner, cedar and pine, deck and patio cover, \$56,000. Rodney, x3401 or 484-3126.

Sale: Austin/UT large condo/townhouse, 3-2.5, pool, 1 blk. to UT shuttle, ex. cond., will consider lease. Al Lapidus, 282-3543 or 488-2429.

Sale: League City 5-3-2, 3,000+ sq. ft., both formals, den, study, gameroom, large pantry, fenced, above ground pool, no equity, assumable VA, \$98,000. Joyce, 282-3314 or 332-1774.

Lease: Split level condo, 1-1, cathedral ceiling, FPL, walk-in closet, W/D hook-ups, balcony patio, \$375/mo. 643-5567.

Lease: Baywind II condo, 1-1, FPL, all appliances, pool, gameroom, tennis. Jim Wiltz, x5437 or 944-0451.

Sale/lease: Austin/UT condo, on pool, 4 blks. to law school & stadium, assumable, no equity. B. Craig, x4031 or 420-2936.

Sale: '84 Fleetwood 14 x 80 mobile home, 3-2 storm windows, now in park in Alvin, low equity, assume notes of \$266.50/mo. Wilbur, x3125 or 331-4280.

Sale/lease: Baywind I condo, 2-1.5, furnished, W/D, downstairs, \$430/mo. or sell for tax appraised value. 333-3992.

Sale: University Green 3-2-2 townhouse, den, FPL, single level end unit, lots of glass, deck, patio, neutral decor, \$85,000. Ben, x4471 or 796-2541.

Lease: University Trace 1 BR townhome, W/D, 2 ceiling fans, pools/jacuzzi, \$395/mo., avail. 6-28. Judy, 488-9511.

Rent: Galveston Jamaica Beach marina house, sleeps 8, city services, central AC, \$390/wk. 337-3970.

Lease: Pipers Meadow 4-2-2, 2,250 sq. ft., fenced, 2 story, community pool/tennis, pets OK w/deposit, \$625/mo. + dep. Jim, x5933 or 486-4083.

Sale: Wooded land in Bastrop area, water and util. avail., 50 acre minimum tracts or the whole 1,650 acres, \$2,500/acre, owner financing, 25% down. Lucille or Art Booth, (512) 237-4150.

Sale: 101 acre ranch, Marlin area, \$775/acre. 488-8105.

Sale: Pearland 3-2-2, beautiful cond., drapes, mini-blinds, walk to school/park/library, assume 10.5% FHA, \$74,500, no equity asked, you pay closing. 485-0076.

Rent: 2 furnished rooms w/priv. bath, on Galveston Bay near Clear Lake, \$50/wk. Ann, 559-2020.

Sale: Lakefront lot and lakeview lot, large and lots of trees, near marina. (409) 855-2063.

Sale: Newport, League City 3-2-2, custom built home, FPL, fans, drapes, built-in cabinets, extra large MBR, bath and closets, shaded fenced yard, lots of trees, \$74,000. Sharon, x5933 or 554-5979.

Lease: 1 BR condo, W/D, FPL, tennis/exercise/sauna, 2 wks. free. Jim Briley, x2546 or 488-7901.

Sale: 3-1 at Horseshoe Lake Estates, Romayor, TX, AC, furnished, 1 acre, fishing lake, Trinity River. Susan Peterson, x3138 or 479-5594.

Sale: Pipers Meadow 3-2-2, 403 Capehill, dining, FPL, miniblinds, nice, must sell, only \$64,900. 480-6516.

Cars & Trucks

'86 Toyota Corolla, 7K mi., auto, 4 dr., AC, AM/FM/cassette, assume lease at \$180/mo., 42 payments remain, small transfer fee. 282-3314 or 332-1774.

'76 Impala wagon, ex. trans., must sell, \$795. 486-9377.

'63 Falcon Ranchero, 6 cyl., std., good engine, all original, very gd. cond. Beatty, x2673 or 482-7938.

'76 Camaro, AC, PS, PB, new paint, really clean, \$1,800. Vance, x4513 or Bev, 326-6392.

'75 Fiat 124 Spider convertible, 72K mi., new top, runs well, good interior, paint faded, some rust, \$1,500. Guy Gardner, x3856 or 532-3413.

'81 VW Scirocco 'S' model, 5 spd., AC, AM/FM/cassette, ex. cond., \$4,295.

Alan, x2541 or 480-1258.

'79 Corolla, AC, AM/FM/cassette, 4 spd., new tires/paint/alt./carb./fuel pump/valve job, no rust, ex. running cond., \$2,250 OBO. Mike, x3532 or 486-8569.

'80 Dodge window van, B150, V8, 3/4 ton, Sportsman Deluxe, very clean, 8 pass., PS, AC, 2 tone blue, ex. cond., \$3,250. 280-8796.

'82 Porche 924, red, leather, stereo tape, removable top, low miles, very clean, ex. cond., \$9,500. 280-8796.

'73 Mercury Comet, 302V8, auto, 130K mi., good engine and trans., brakes need work, \$200. Keith, x3486 or 280-9793.

'78 Monte Carlo, good cond., runs well, AC, new tires, \$1,350 OBO. Freda, x5266 or 488-2334.

'79 Ford Fiesta, AC, AM/FM stereo, sunroof, must sell, \$1,190. 487-4325.

'86 Cavalier Z-24, fully equipped, pristine condition, 5 yr. unlimited warranty, no equity, assume payments of \$353.90/mo. SSgt Phelps, x2716 or 944-8100.

'83 Toyota 2 dr. sedan, very clean, stereo, PS, auto, asking \$5,900. Briggs, x5165 or 333-2717.

'84 Camaro Z28, 5.0 HO, red/beige, fully loaded, T-top, ex. cond., \$8,250. Mike, 266-5511 or 333-2335.

'77 Camaro, red, good paint job, student will sacrifice at \$2,000. Cheryl, x5161 or 538-3043.

'79 Pontiac Firebird, new air, good cond., \$2,400. Ray, x6327 or 554-5434.

'83 Toyota Celica GT liftback, loaded, 32K mi., ex. cond., \$6,500 firm. Dave, x2421 or 559-2852.

'81 Olds Toronado, low mi., ex. cond., fully loaded, must sell, \$4,000 neg. Cindy, 280-1816 or 332-1075.

'69 Mercedes 280 SL, AT, AM/FM/cassette, 2 tops, rebuilt engine, \$9,000. 554-5002.

'73 Datsun 240Z, ex. cond., \$3,000. James, 280-0539.

'71 Lincoln Continental Mark III, 460, great for restoration, needs battery, \$200 OBO. Brian, 326-3829.

Recreational

'76 Hex Flite 18 ft. travel trailer, self-contained, AC, furnace, oven, refrig., shower, \$1,700 OBO. 332-3678.

Rent: Starcraft pop-up camper, AC, sleeps 6, \$180/wk. or \$28/day. Glen, x5629 or 480-3015.

'73 Starcraft, 20 ft., self-contained travel trailer, very clean, one owner. 333-3905.

Boats & Planes

22' Chriscraft Seaskiff, cuddly cabin, rebuilt 185 HP inboard, custom trailer, classic looks, solid & seaworthy, in slip at Nassau Bay Marina, \$7,500. David Youngblood, x4111 or 333-4562.

16' Invader bass boat, 65 HP Mercury, T&T, troll, recorder/flasher, 2 gas tanks, 2 batteries, live well, auto bilge pump, extras, one owner, like new, \$3,500 OBO. Gene, x2855 or 334-1505.

'81 Formula, 23', 200 HP, full canvas, cabin, ex. cond., \$17,000. Cindy, 280-1816 or 332-1075.

18 ft. AMF Trac catamaran, trailer and extras, like new, \$3,990. 333-3056.

S-2 sloop rig, 7.2 meter, 3 sails, 7.5 HP Honda O/B, sleeps 4, porta potty, full elec., \$11,500 OBO. Sandy, 538-2031.

'76 Wellcraft V-20, cuddly cabin, 165 HP, I/O, SS prop, best offer or trade for smaller boat. Vic Booth, x5231 or 532-4260.

Invader trihull, WTW, 50 HP Merc., galv. trlr., extras, all ex. cond., fresh water use only, garaged, \$3,500. 729-1209.

Cycles

'82 XL Honda, less than 1,000 mi., ex. cond., street legal, \$450. Cheryl, x5161 or 538-3043.

Men's lightweight Raleigh Gran Sport 10-speed bicycle, ex. cond., low miles, several accessories, \$125 OBO. Tim, x3831 or 482-2425.

3spd. bicycle, 30" wheels, hand brake, \$30. Bauch, 333-3382.

'79 YZ 400 and 125 dirt bikes, both w/rebuilt motors, 400 runs great, \$500 takes both bikes. Jeff, x6128 or 488-7106.

Schwinn 10-spd. bicycle, 23", ex. cond., \$100. Jerry, x4145 or x5389.

'79 Honda CB 650, ex. cond., crash bars, padded sissy bar, \$950 OBO. 482-4874.

10 speed bike, \$35. 333-3056.

2 Men's Ross 10-spd. bikes, ridden only 30 mi., lifetime guarantee, cost \$110 ea., sell for \$100 ea. Steve, 331-6671.

Audiovisual & Computers

IBM PC jr, 256K, NEC amber monitor, Panasonic printer (Model KX P1091), carrying case, adapter cable, software,

like new, \$850. Jay, x3071 or 481-2335.

80-column card and manual for Apple IIE computer, \$50. 334-1934.

Realistic #33-1085 stereo electret microphone with mic stand and boom, \$50. Tom Clark, x7445.

Tandy PC-5 pocket calculator, 4K RAM, Basic and Assembly lang., cassette interface and printer, \$100. Tom Clark, x7445.

Free telephone relays and hookup wire; HP low frequency signal generator. Jim Sarp, 488-3300 or 486-8564.

Household

Sealy double sz. boxsprings and mattress, \$75. Jeff, x6128 or 488-7106.

Deluxe king-size waterbed, 5 mo. old, superior mattress, 4-drawer platform, heater, solid oak rails/nightstands/light bridge, 4 yrs. of chemicals, many accessories, cost \$2,000, sell for \$1,500 or assume \$75/mo. payments. Brian, x5111 or 480-5194.

Wards 20 cu. ft. upright freezer, clean, \$100. 554-6235.

Jenny Lind crib with Simmons mattress, \$50; matching high chair, \$15; stroller, \$20. Gayla, x5316.

Pine bunkbeds, barely used, in good condition. Linda, x4744.

English antiques: oak dining table & chairs, \$350; working barometer, \$300; 6 mahogany dining chairs & matching chaise, ex. cond. & rare, \$900. 554-5002.

Beige couch, good cond., \$75; brown veneer office desk, 60" wide, \$75. Mark, x6101 or 486-0909.

New Brother KH910 computerized knitting machine, cost \$995, sell for \$875; garter carriage, \$250; will teach to use. 482-8262.

ELNA SU air electric sewing machine, 3 yr. old, less than 20 hrs. use, \$800. 331-4227.

Brother Electroknit KH910, 6 mo. old, \$800. 331-4227.

King size waterbed, heater, mattress and mirrored headboard. Terry, x4678.

Antique dining room table and 4 hand carved chairs, \$350; antique buffet, \$350; office table, \$25; Oxford file cabinet on rollers, \$35; two 1-drawer files, \$35 for both; new loveseat and matching chair, \$275. 488-5564.

Sears upright frostless freezer, 15.3 cu. ft., \$250; Fiestaaware dishes; Lenox Montclair dinner plates, \$15 ea., matching crystal, \$10/stem. Suzette, x5018 or 554-7371.

'86" couch w/hideaway bed, beige w/brown plaid, \$150. 946-4034.

Wanted

Want vocalist for ContraBand swing band, 20-pc. volunteer big band. Ray, x6327 or 554-5434.

Want Mars globe, all commercial stocks sold out—any extras out there? Jim, 337-2838.

Want heavy duty bunk bed frame capable of supporting adults, no mattresses needed. 337-3970.

Want to buy '83-4 customized van, must have dual side doors, prefer 4 captains chairs and couch/bed. SSgt Phelps, x2716 or 944-8100.

Want to rent 2 or 3 BR beach house, to sleep 6-8, for 1 wk. in June/July/Aug., Galveston or Surfside area. Jacobs, x3561.

Want to buy/trade hardcover copies of American Heritage. Brian, x5111.

Maternity clothes needed. Sam, x2059. Retired individual looking for yardwork or landscaping. Joe Marks, 734-4058.

Want Garrett metal detector, Model 7 or 6ADS, price neg. Lynn, x4468 or (409) 925-6780.

Roommate to share furnished 3 BR Meadowgreen home, W/D, cable, VCR, fan, FPL, \$225 plus 1/3 util. 480-5752.

Want super-8 movie projector, used & in good cond., cheap. Dave Flanagan, x6186.

Seeking witnesses to collision at 7:10-4:23 at intersection of Space Center and West Linkage Dr., vehicles were black Blazer and red & white van. Loftus, x2194.

Want to buy used midsize Wilson Sting tennis racquet, 4 5/8. Vincent Levy, x3035 or 333-1316.

Want female to rent master BR, kitchen and W/D privileges, \$200/mo. + 1/2 util. & \$100 dep. Bekki, 2141.

Rock & roll band looking for members in this area. Steve, 331-6671.

Want responsible roommate to share 3 BR home in League City, male or female, \$200/mo. + util. 554-7706.

Want old lawnmower parts. Jim, x4241 or 532-1361.

Want carpool from Fairmount Pkwy. & Preston in Pasadena to JSC, 8 a.m. to 4:30 p.m. shift. Carol, x5996.

Want luggage rack for VW Rabbit. Linda, x4744.

Pets

Labradors, spayed and heartwormed,

great with kids but need a home. Jim, 337-2838.

Doberman puppies, AKC, 6 wks. old, tail and dewclaws removed, wormed and first shots, come back for 2nd set, \$250. Horton, x4084.

Shepherd/collie, free to good home, house trained, obeys commands, good with kids, good watch dog, about 5 yrs. old. Tucker, x5056 or 534-3415.

2 AKC registered Chow-Chows, female cinnamon, shots and wormed, 4 mo. old. Erma, 480-3194.

AKC Cocker Spaniel puppies, males & females, buff and buff/blond, born 2-1-86, shots/wormed, \$150 & up. Joyce, 282-3314 or 332-1774.

Registered collie puppies. Cindy, x3289 or 538-1878.

Musical Instruments

Two Suzuki violins, 1/8 size, \$125; 1/4 size, \$125. Al, 280-2285.

'61 Hammond organ, drawbars, dual keyboards, 1 octave footpedals and bench, cheap. Laura York, 488-9005.

Miscellaneous

MF50 tractor, tandem disc, 2 bottom plow, planter, trailer, 5 ft. box blade, \$5,250. 488-8105.

Brother model 3012 electric typewriter, ex. cond., \$79. Alan, x2541 or 480-1258.

1 carat cluster engagement ring, best offer. Freda, x5266 or 488-2334.

Sears XC4000 exercise bicycle, like new, original cost \$160, sell for \$65. Jay, x3071 or 481-2335.

Pickup truck bed cover, fits short wide bed, good cond., interior light and window screens, best offer. 332-3678.

Gilson 16 HP garden tractor, 42" mower and garden attachments, \$950; Sunfish sailboat, as is, \$125 OBO. 482-4874.

Gympac 1500 weight set, like new, fully assembled, \$175. Mark, x6101 or 486-0909.

Heavy duty weedeater, used 1 season, \$22; cypress electric wall clock, \$25. 488-5564.

Samsonite ladies case, \$25; cabinet doors w/inserts, 8 for \$15; aquariums, stands & accessories. Suzette, x5018 or 554-7371.

Forming A-League basketball team. Paul, x5536.

World Book Encyclopedia, 1985 ed., new, still in carton, \$395. Max, x4545 or 482-7879.

Deluxe hamster habitat cage w/large wheel and exercise globe, \$30. Max, x4545 or 482-7879.

Metal woods #1, 3 & 5, #4 wood, \$60. 554-4320.

Charter Arms Undercover .38 special, 2" barrel, \$155; Charter Arms Pathfinder stainless .22 long rifle, 3" barrel, \$205; Interarms Excam RX22 double action auto .22 rifle, 135; 2 Ruger stainless .357 magnums, \$245 and \$235. Charlie, x3591 or 333-4681.

Buy & sell circulated and uncirculated coins. 488-4859.

Fresh local honey, \$12/gal. or \$3/qt. Welby Ward, x4249.

Pair of jacks for pickup camper, \$100. 554-2470.

Men's Saloman SX 90 ski boots, sz. 9.5. Saloman shell: 350-360, used 3 trips, 2 liner sets, cost \$300, sell for \$100. Allgeier, 488-0397.

Smith & Wesson 9 mm, 3 clips, M-459, \$310; Ruger KM14F, stainless, folding stock, new, still in box, \$325, will trade for Colt Python. Wayne, x6226 or 486-7141.

Hillary tent, 8 x 10; 12' round trampolene; girl's 10-spd.; O'Brien water ski, salom, w/case. Susan, 480-5752.

Slate bed pool table, ex. cond., accessories. 729-1209, 9 a.m. to 9 p.m., or 495-4635.

Gilruth Center News

Call x3594 for more information

Ladies weight training — This popular course begins June 12 and runs for 4 weeks. The class meets Mondays and Wednesdays from 7 to 8 p.m. The cost is \$20 per person.

Word processing — Work with a variety of word processors in this class, which will cover Word Star and teach you how to do legal letters, resumes and other documents. The 6-week course begins May 29 and meets from 5:30 to 8:30 p.m. The cost is \$190 per person.

Defensive driving — Learn to drive safely and qualify for a 10% reduction in your auto insurance for the next three years. This all day Saturday class meets from 8 a.m. to 5 p.m. June 14. Space is limited.

Belly dancing — That's right, Belly dancing. Tone muscles while learning this ancient art form. Students are requested to wear a leotard and tights and bring a scarf to class. This 6-week course begins June 11 and meets Wednesdays from 5:30 to 6:30 p.m. The cost is \$35.

SCUBA lessons — This NAUI-certified SCUBA course begins June 16 and meets from 6:30 to 9:30 p.m. The cost is \$45 per person. No equipment is necessary prior to the first meeting. Enrollment is limited.

Calligraphy — Learn basic italic and old English lettering. This class meets for 5 weeks starting May 29. Sessions are from 7:15 to 9:15 p.m. and the cost is \$20 per person. No materials are needed for the first class.

Cookin' in the Cafeteria

Week of May 19 — 23, 1986

Monday — Cream of Potato Soup; Franks & Sauerkraut, Pork Chop, Potato Baked Chicken, Meat Sauce & Spaghetti (Special); French Beans, Buttered Squash, Buttered Beans. Standard Daily Items: Roast